Abstract

We propose the delay fission investigation which will be the indication of the hypernuclear production and decay within the atomic masses region near 200. The aim of the experiment is to measure the hypernuclei electroproduction cross section and Λ-hyperon lifetime inside of a heavy nucleus.

Proposed measurements demand the utilization of high energy electron beam facility with low angular emittance and high current. Other parameters such as high duty factor and compact beam spot dimensions at the target are also required. Actually these beam characteristics are offered by Jefferson Laboratory only.

Despite the fact that hypernuclear physics has about 40 years of history, the experimental investigations have been made predominantly for hypernuclei within atomic mass number ≤ 20. Available data are rather scarce and have large uncertainties. This is due to the tremendous difficulty in the hypernuclei production and subsequently - due to the detection and identifying problems of their decay products. Only two heavy hypernuclei - $^{209}Bi_{\Lambda}$ and $^{238}U_{\Lambda}$ have been experimentally observed and their lifetimes were measured with very low accuracy.

The hypernuclei lifetime is a fundamental quantity. Its knowledge is required to verify different concepts of the nuclear structure and hadron interaction. The investigation of hyperon decay in nuclei may provide the information about the influence of nuclear media on weak Λ-hyperon decay, quark structure of hypernuclear system and so on. One of the problems still existing is the search for long-lived hypernuclei whose existence may be due to the delaied decay of a Λ-hyperon in the strong intranuclear electromagnetic fields. It was predicted by Salam and Strathdee in connection with the expected symmetry restoration in such circumstances.

The delay fission cross section caused by hypernuclei production is about $(2.5 \pm 1.0) \times 10^{-5}$ of prompt fission cross section. The lifetime of delay fission is some picoseconds.

We propose to carry out the measurements of electroproduction cross sections for $^{197}Au_{\Lambda}$, $^{209}Bi_{\Lambda}$ and $^{238}U_{\Lambda}$ in the electron energy range $1 - 2GeV$ and their lifetime determination.

The measurements will be performed using the recoil-distance technique in projectile modification and solid state fission fragment detectors.

The Kharkiv members of this collaboration have good experience in this field of investigation, while the Sao Paulo group has long time developed solid state fission fragment detectors technique.

In principle, the aim of our proposal is very similar to the proposal of E95-002 [16]. But we have to stress that proposed method is very different. In this case our experimental data may complement others by E95-002 and could be used for the comparison and more deep analysis. Anyway, actually such measurements could be performed only at Jefferson Laboratory and to check the reproducibility of experimental results it is possible only here. We believe that using this way the final answer about heavy hypernuclei formation and their lifetime could be found.